
Introduction

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PRODUCTIVITY AND GROWTH

Part II of the *Handbook* is devoted to debates about the relationships between regional innovation and growth, on the one hand, and aspects of industrial organization that they are influenced by, facilitate and form, on the other. Much of this part therefore contains interesting discussions about the meaning of regional innovation and growth for broader evolutionary processes that shape economic geography. It draws on issues foreshadowed in the general introduction to this book (Chapter 1), namely productivity and regional inequality, which will be only briefly summarized here. Then it moves into a group of chapters that investigate debates about the nature of spillovers, especially knowledge spillovers, in the economic geography of agglomeration, and questions whether and in what ways specialization of agglomerations is preferable to their diversification for fostering innovation or not. The conditions under which these debates resolve one way or the other constitute an important inflection point for the evolutionary economic geography project of the book.

To recap, Chapter 8 by Roberta Capello and Chapter 9 by Daniel Felsenstein argue the following. First, there is a high degree of confluence in the views that the relationships between innovation and productivity devolve into three: these are represented, first, by new economic geography (or the functional approach to regional productivity) whereby regional innovation is highly interrelated to issues of market-size and pecuniary externality effects, agglomerating where the lead region is found (rather like Vernon's initial product life-cycle take on innovation). This tends to produce misleadingly over-concentrated (extreme regional disparities) analytical results. A better alternative is new growth theory (NGT), which focuses on impacts of innovation externalities from human capital on endogenous technological change hence regional productivity and growth. This theory supports the deduction that the higher the average level of human capital, the more rapid the diffusion of knowledge, the higher the level of regional productivity (including earnings). This is similar to Capello's structural approach. In other words high human capital, absorbed externalities (for example knowledge spillovers) and communicative or networking power combine to produce regional advantage. But these models are confused by a 'regional innovation' effect which is clarified by evolutionary economic geography (EEG), or Capello's cognitive approach, which sees institutions, organizations and cultural practices as critical to generating regional growth. This is where modelling that includes cultural proxies like 'relatedness' of industry, social networks and spin-off activity is conducted, confirming the advantages for growth from innovation fostered in, or utilized at distance by, agglomeration incumbents.

SPECIALIZATION OR DIVERSIFICATION?

Regions endowed with the above-mentioned assets will forge ahead and maintain a lead over others by replenishing those capabilities, especially in the globalized knowledge economy. Moreover, regions that evolve those capabilities may narrow the lead region's advantage, possibly overtaking it in the long term, especially if the lead region backslides or becomes 'locked in' to negative path-dependence effects. These are guarded against by evolution of firm, knowledge and regional variety, agility and innovation, which assist new, more diversified path creation. Chapters 10 and 11, by Stefano Breschi and Simona Iammarino respectively, address this portrayal of regional economic evolution head-on.

Breschi's interest is in knowledge spillovers in relation to growth, focused on innovation using knowledge from concentrated or dispersed sources. Endogenous growth theory addresses the issue raised in the 'Introduction', Chapter 1, to this *Handbook* regarding the public nature of knowledge. There, the discussion was about the likely impact of university research as spillovers into the regional as opposed to the global economy. Hypothetically, and with some evidentiary support from the 'relatedness' perspective (see Boschma and Frenken, Chapter 14 in this *Handbook*), spillovers can be expected to be a majority, since much research on geographical knowledge spillovers shows there to be a more or less rapid distance-decay effect based on such indicators as patent citations. Geography is thus important to spillover absorption, but the magnitudes of outward leakage or, conversely, inward infusion of valuable knowledge from interregional or international research, publication or patenting partnerships, is simply unknown although likely to be a hot topic, especially in times of straitened research and teaching budgets at research universities.

Endogenous growth theory thus purports to explain how new knowledge is internally generated by investments in R&D, but because ideas are free, its benefits are not confined to regional innovators networked to the knowledge source. Even patenting does not protect; rather, it allows a rent to be charged by the inventor to subsequent users. Incidentally, this also means that in effect the real productivity of this kind of knowledge is also not known. However, to the extent that research has been conducted into this problem, its results are probably an underestimate. Hence, open science increases the productivity of the research process for unknown numbers of firms in the region as well as the broader global economy. In pursuit of some purchase on this question the neoclassicals (for unclear reasons known as MAR, the acronym for economists Marshall, Arrow and Romer) with their knowledge production function econometrics incline to the view that specialization of knowledge spills over most fruitfully for firms (see Vatne's Chapter 4 on 'Romer externalities' in this *Handbook*). Research from a more eclectic viewpoint more in tune with evolutionary economic geography is cited by Breschi as supporting the conclusion that a diversified knowledge base is more friendly to innovation performance (see Vatne's Chapter 4 on 'Jacobs externalities', and Boschma and Frenken's Chapter 14, in this *Handbook*). However, he also notes research showing that this can vary over time and space, for example Tichy's (see Chapter 5 in this *Handbook*) observations about new agglomerations housing innovations would be illustrative of this 'creative disruption' of an established innovation surface. Accordingly, against an inclination to favour sectoral specialization in understanding innovative performance, Breschi's review conclusions incline towards 'variety' being a better explanation.

VARIETY AND NETWORKS

Simona Iammarino's Chapter 11, on 'Regional innovation and diversity' expressly explores this contention. As she puts it: 'In other words, are the most innovative and fast-growing regions sectorally specialized or diversified?' Her starting premise is that the answer to this question not only may be unknown, but may be unknowable, given the complexity of links between variety and innovation at the regional level. In light of the conclusions of the preceding chapters in Part II, this is a salutary observation. Iammarino points out that even Jane Jacobs did not expect variety or diversity alone to yield up regional growth. Nevertheless she saw the key cross-pollinations being inter-industry, unlike MAR for whom they are interfirm, and the former are, she thought, likely to produce the greater regional economic returns. Moreover, Iammarino points out, despite the difficulties posed for analysis by sector, structure and methodology, more and more research results in the burgeoning field of variety and growth incline to the conclusion that variety is more associated with regional economic growth than specialization of industry. But, reiterating Jacobs's injunction that variety is not automatically growth-inducing, she underlines that it must be used and exploited, and therein lies the paradox that some diversified regional economies have poor growth performance. As noted in the 'Introduction', Chapter 1, to this *Handbook* and elsewhere (Chapter 14) there needs to be a distinction between 'diversity' which can run the whole gamut of regional economic structure, and 'variety' which need only be a segment or segments ('revealed related variety') of the regional industrial bandwidth. So the balanced judgement of Iammarino is that variety is a desirable but by no means sufficient condition for regional innovation and growth, and that it may be meaningless unless energized by the regional regime of intermediaries, social capital and forms that comprise it.

This perspective is explored in some detail in Elisa Giuliani's Chapter 12 on 'Networks of innovation'. Innovation is precisely dependent on networks of innovators within firms, and between them and knowledge institutions. It relies on numerous sources that must be connected for the knowledge recombinations opened up by the innovation paradigm to be fully explored and exploited. Such networks display four dimensions around which performance may revolve. These are the following. (1) Network formalization, that is, how legitimate or authoritative is it? (2) Network actors, for example for innovation negotiation, scientists or administrators, and if the latter, budget-controlling or not? (3) Network methodology, that is, should it be understood in terms of process or substance? (4) Network geography, global or 'only' local? Network layers also seem crucial, the thicker the better, that is, market only is thin and probably associational; market plus social is thicker and more 'communitarian'; market, social and policy is thickest and capable of innovation paradigm-regime communication, consensus and committed action. Clearly these thickened networks are a precise model for using and exploiting 'variety' of the kind that Iammarino sees Jacobs recognizing as having major potential for realizing regional innovation and growth.

Finally, in Chapter 13 Lisa De Propris and Olivier Crevoisier inquire about the degree to which agglomeration, whether specialized or diversified, needs regional anchoring elements, apart from the thickened networks that may interweave regional variety for positive innovation purposes. 'Anchoring' has meant three loosely related things over time. Initially it embodied the idea that a regional economy might benefit from having

an endogenously evolved industry complex (for example shipbuilding, aeronautics plus suppliers). Subsequently, and in respect of constructing regional advantage based on new industries, the anchor question concerned what would be the supply-side characteristics (for example skills, subsidies, knowledge) that would attract them. Nowadays, anchoring is a territorial or 'space of flows' hub capability in transceiving and transforming global knowledge for innovation. Referencing origination of the anchoring concept in analysis of biotechnology clustering, the authors observe that productivity gains accrue from the lowering of transactions costs, other pecuniary externalities (for example asset sharing), and innovation based on interactive learning. This explanation works *ex post* but the questions of cluster emergence and cluster vulnerability to insufficient 'variety' arise. In other words: how can such clusters be reproduced; and how can they be insured against anchor overspecialization and vulnerability to path-dependence, 'lock-in' and obsolescence, such as occurred in Boston's minicomputer cluster? An answer lies in enhancing the 'process' function of such complexes and looking for innovation gains from related variety (see Chapter 23 on 'Transversality' in this *Handbook*). On the basis of such 'platform-building', strong links can be made to a more diverse range of global industries interested in accessing 'platform technologies'. De Propriis and Crevoisier envisage a forerunner of this kind of anchoring in today's Swiss watch-making industry, which is no longer anchored in a sector or even a regionalized supply-chain, but rather in an interlinked arrangement of capabilities stretching across, integrating and adapting various technologies including micro-electronics, optics, micro-mechanics and material sciences, into one nodal innovation system.

Hence, the chapters synthesize a view of the evolution of regional innovation as bifurcating asymmetrically along lines that, on the one hand, underline the importance of industrial specialization for innovation, as espoused not only by MAR but also by Michael Porter in the cluster basket; and on the otherhand, a newer line that advocates, guided by the insights of Jane Jacobs, the virtues of diversification, moderated by theoretical refinement, to the more nuanced concept of 'variety' or, more generally, 'relatedness'. This seems to enhance prospects for regional innovation and growth through territorial knowledge dynamics based on 'transversality' while not condemning the region or, at a smaller scale, the cluster to vulnerability from overspecialization, narrow path-dependence and possible innovation inertia. These findings resonate clearly with those culminating in the chapters on the way neo-Marshallian industrial districts seek to cope with the challenge of globalization: flexibility, agility, design and innovation. To these may be added the promotion and evolution of judicious regionally related variety.